BEFORE THE FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Public Notice. Spectrum Needs for the Implementation of the Positive Train Control Provisions of the Rail Safety Improvement Act of 2008	 DA No. 11-838 WT Docket No. 11-79

Filed on ULS in the captioned docket.

SkyTel Ex Parte Written Presentation, October 25, 2011

SkyTel submits the attached paper from *Ron Lindsey*.[*] This expands upon his past presentations in this docket. *All of the content in the attached is relevant to this docket.*

The content of all of Mr. Lindsey's submissions in this docket, and in the attached, was fully up to him. SkyTel funded these, and requested only his objective comments on issues in the docket in the public interest. SkyTel also offered to pay further for his time to attend another meeting before the FCC if the FCC and any other serious party or parties to this docket chose to have such a meeting. Meeting in person can be more open, honest and productive than paper debate.

Respectfully,

Warren C. Havens
President of each of the following entities

Skybridge Spectrum Foundation
ATLIS Wireless LLC, V2G LLC, Environmentel LLC, Verde Systems LLC
Telesaurus Holdings GB LLC, Intelligent Transportation & Monitoring Wireless LLC

2509 Stuart Street
Berkeley California 94705
www.scribd.com/warren_havens/shelf
510 841 2220 x 30 – phone | 510 740 3412 – fax

[*] *The attached is proprietary, but due to the special public-interest assertions in this docket, Mr. Lindsey agreed, upon fair payment by SkyTel, to allow this to be submitted, but only for use by parties in this docket and the FCC: this is stated on each page.*

SkyTel notes.
- This is Proprietary. See footer on each page.
- SkyTel added the yellow highlights.

Full Spectrum

Wireless Gone Awry

With the digital age came phenomenal mobility, both physically and virtually. And with that mobility we are becoming exponentially dependent upon wireless spectrum. Fortunately, digital processing has been advancing at a rate that has permitted the wireless spectrum to be used more efficiently, thereby compensating hopefully for the increase in demand. Unfortunately, major users of private wireless networks have not kept pace with their commercial cellular counterparts in doing so.

For nearly a decade the railroads have had the opportunity to advance the efficiency of their primary wireless infrastructure, but they continue to reject the technologies that could permit such advances. Amazingly, such investment would be quite small above that which is already required by the railroads to shift to a digital platform to meet a 2013 deadline for an FCC Point & Order. Now, with the mandate of PTC and the additional requirement for wireless data to support PTC's deployment, the railroads are seeking additional spectrum instead of increasing the efficiency of what they have to support PTC. Unfortunately, building more infrastructure whether it be track, yards, or wireless, instead of increasing the efficiency of those resources has been a traditional method for railroads to meet increasing demands. Fortunately, while several, but not all, are beginning to improve the efficiency in their primary resources so as to minimize further investment, they have failed to do so with their wireless networks.

So! Is the railroads' request for additional spectrum really necessary? And, how can that be determined? If additional spectrum is required, then what are the alternatives? The FCC would like to know, as should all others that recognize their responsibilities in using this very limited resource.

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Ronald A. Lindsey • 1828 Cherry St.• Jacksonville, FL 32205 ✻ (904) 386 3082 ✻ comarch@aol.com
www.strategicrailroading.com

Dear Reader

I am now approaching the end of 15 years of publishing this quarterly journal. The material presented here has never been more appropriate for railroads and suppliers to consider. However, many of these organizations seemed to be even more determined to not pursue primary operational issues such as "Do you know where your train is… and whether or not it is actually moving?" Fortunately, there are fabulous exceptions, most notably NS and BNSF, with their advancements in advanced traffic management via GE and Wabtec respectively. Perhaps it is the PTC mandate that is focusing too much of the railroads' technical resources on that singular challenge … or perhaps it is their lack of strategy from a business perspective in sync with a technology strategy - what I refer to as ***Strategic Railroading***, hence the purpose of my blog www.strategicrailroading.com.

One particular point is how the railroads overall have outright failed to take advantage of the FCC's narrow-banding mandate, a.k.a. *refarming*, that requires replacing the analog 160 MHz infrastructure with a digital infrastructure eventually. The railroads are doing so now, but with a conventional approach that continues the inefficiencies of their analog infrastructure as to spectrum utilization. I see this as a true lack of wireless citizenship especially in light of their pursuit of additional spectrum via the efforts of PTC-220, LLC.. I see this as ***Wireless Gone Awry***.

Your comments and further inquiries on this topic are, as always, encouraged and appreciated.

Thanks,

Ron

904.386.3082 … or … comarch@aol.com

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Blending

The majority of wines produced in France are either a blend of various vintages of the same grape and/or a blending of various grapes. That country in particular has a set of laws in place that require a wine that is produced by a particular region such as *Bourdeaux*, for example, to contain specific minimum / maximum %s of various grape(s). With Champagnes, a term that may only be used legally by vintners of sparkling wines in the Champagne region of France, the bubbly is at least a blending of Chardonnay and Pinot from various years. Such practices are not meant to be deceptive so as to cheat the consumer. Rather, the notable Champagne houses strive to provide a consistent "house flavor", if you will, over the years so as to service and maintain the loyalty of their customers. When they deem it appropriate, they make a "Vintage" Champagne for a particular year, as so noted on the bottle, which means that the mixture of grapes were of that year only. While it is the vintage Champagne that demands the premium price in the market, it is the consistency in the blending of various vintages that "brands" the house over the years.

As with France, there are laws in the U.S. that define the limits of blending of different grapes. However, unlike France that identifies the wines by region and appellation, U.S. vintners classify their wines by the grape, which by Federal law must be at least 75% of the mixture. With the intent of finding a compromise between French and U.S wine regulation, the concept of "Meritage" was granted by the U.S. Department of Trademarks and Patents in 1989, that avoided both the regional (other than U.S.) and % grape criteria. Stemming from "merit" and "heritage", the term was chosen to support U.S. wineries in marketing a "Bordeaux-esque" of premium wines,

Personally, for a number of years I have been practicing my own version of blending, not of grapes or vintages, per se', but rather a blending of bottles. That is, I have been blending inexpensive (cheap) wines to create an elixir of exceptional quality (for the price-point averaging less than $12 per bottle). This is not just an art, but also a necessity when one is self employed. Really! Almost anyone can blend good wines to create a decent wine. But, it takes true compassion, if not necessity, to create a decent wine when considering only sub-marginal wines with each having a singular quality, but not overall complexity to make it a decent wine. Now, I must state that red wine drinkers are less likely to consider such a process in that they tend to take great pride, or seek assurance, that what they buy has been properly blended by the vintner. Us Chardonnay drinkers are less pretentious I believe, and more receptive to taking our chances. BTW, I wouldn't do this blending thing with Champagne. First of all I can't afford it (the price issue), and second it would be an insult to the French: I save my insults for other interests as demonstrated in this and previous ***FS***s. So! Those individuals with similar interests, or necessity, in blending wines are encouraged to share your experiences with me as I will do in return.

While ***Pure*** can be an important characteristic in various aspects of our lives, it is the ***Blend*** that delivers the greatest value in the majority of cases. So! I ask: What's with the 220 MHz hoopla. Read on.

Wireless Gone Awry

In May 2011, a *Public Notice* was issued by the Federal Communications Commission (FCC) regarding WT Docket No. 11-7, ***Spectrum Needs for the Implementation of the Positive Train Control Provisions of the Rail Safety Improvement Act of 2008*** (RSIA)***.*** The primary objective of the *Public Notice* is to seek . . .

> "comments regarding policy actions that would further facilitate the acquisition of spectrum by railroads subject to the RSIA for PTC implementation."

By means of this activity the FCC wishes to obtain . . .

> "information regarding any testing that has been performed on PTC systems (utilizing various frequency bands and amounts of spectrum) in the United States or in other countries."

The issuing of the Docket and the respective *Public Notice* primarily stems from the request of FCC by PTC-220,LLC[1] to provide more spectrum in the 217.6 - 220 band with contiguous 25 kHz channels in addition to that which PTC-220 already owns.

Perhaps at first glance, obtaining more spectrum for nationwide deployment of PTC, a seemingly unprecedented wireless technology crisis for both the freight and passenger railroads, would seem reasonable and justified. However, there are a number of points to be made along with a number of questions to be asked and answered before such an allocation is made . . . and hence the FCC's Docket . . . and hence this ***FS***.

I am not saying that PTC-220 is wrong in their request for more 220 spectrum. But, that doesn't mean that they are correct. The truth is, ***NO ONE*** really knows what amount of spectrum is needed, and where.

Finding fault with PTC-220's request begins by reviewing its submission to the FCC's *Public Notice* that has incorrect and purposely misleading statements that the FCC may find credible and relevant given their lack of railroad domain knowledge, It was in this light that I made a submission to the *Public Notice*, followed by a submission critiquing the submissions made by PTC-220 and others, Subsequently, I made a presentation to the FCC[2]. My written submissions and a PDF of the presentation deck are public documents available via request to comarch@aol.com.

[1] The entity jointly owned by BNSF, CSX, NS, and UP that owns and manages the deployment of spectrum in the the 220 band that is to be used for PTC, along with the 44 Mhz spectrum of Meteorcomm.

[2] Skybridge Spectrum paid my fees and expenses for these activities but provided no constraints nor interfered with the objectivity of my submissions / presentation.

To understand the requirements for wireless to support PTC, I will address below a number of areas, including

- ***Looking Back*** as to the use of spectrum by railroads;
- ***Understanding Demand***;
- providing a critique of ***Submissions*** made to the *Public Notice*;
- listing questions that are ***Asked & Answered;*** and
- ***Moving Forward*** with determining spectrum requirements.

Looking Back

The request for additional spectrum for safety systems is not new to the industry in general, and UP especially. It was 2 decades ago that the AAR (effectively UP) sought 900 MHz spectrum to deploy Advanced Train Control System (ATCS). The FCC gave 6 nationwide pairs of 900 to the AAR (this was before the Feds recognized the value of bidding on spectrum for the cellular industry). ATCS was a vital traffic control system that incorporated enforcement, and it was doomed to fail from the beginning partially due to its dependence upon on-board interrogators and in-track markers for position and other data (especially when compared to BNSF's ARES that used GPS and existing 160 MHz channels for data). Even though ATCS was not deployed, and hence the 900 frequencies were not so required, the channels were kept by the railroads and used for business purposes and not safety as was the specific purpose stated by the AAR in their request of the FCC.

Side Point: Indeed, the 900 is being used now in lieu of wired code line by a number of railroads. But, that is not a safety decision. That is a business decision.

A legitimate point that the FCC should consider in allocating additional spectrum is whether or not the railroads are using their currently available spectrum efficiently. Unfortunately, for the most part, the railroads have shunned their responsibility for several of the bands that they use. The most critical band is the 160-161 MHz band that is required by the FCC to be restructured. In the past, the railroads tightly coordinated the allocation of those channels within the limitations of analog technology. However, with the shift to a digital infrastructure the railroads have rejected the use of technologies that would improve the efficiency of that band tremendously, and perhaps even to the point that PTC could be readily handled as well without the 220.

As has been addressed numerous times in ***FS***, the railroads have proceeded to replace their 250,000 analog wireless units (e.g., base stations, hand-helds, locomotive radios) in the 160 band with digital equipment to meet the 2013 deadline of the FCC to go to narrowband, i.e., to reduce the individual channel width from 25 kHz to 12.5 kHz. Amazingly at first, the railroads seemingly led by UP, decided to replace analog with analog

which would have prevented them from making the transition to a second forthcoming split of 6.25 kHz stated by the FCC, but yet without a deadline. Finally convinced to go to digital, UP and other railroads refused to break away from conventional radio allocation of individual user(s) per channel, and make the transition instead to ***trunked*** radio that dynamically allocates channels as required. In short, this means that the use of 160 is actually more inefficient now relative to what can be achieved digitally then it was in the analog days. This is a critical point relative to major metropolitan areas that have a large number of yard crews requiring their individual channels. Had the railroads deployed trunked radio, it is possible that the 160 network would have been able to handle PTC.

Could trunked 160 support PTC ?

In addition to the 160 & 900 bands that are not being efficiently use, there is one that should be quite noticeable, but yet is being ignored. I am referring to the 44 MHz band that was acquired by PTC-220 from BNSF. With little doubt, this purchase was a concession by PTC-220 to BNSF given that the later was "pursuaded" to use 220 for PTC for the sake of interoperability instead of the 44 band which it had purchased for PTC and other safety applications prior to the mandate. That band, with only infrastructure in place across BNSF to my knowledge, remains untapped by other railroads.

Lastly, as to looking back, UP (again) in concert with NS, bought the current 220 band now managed by PTC-220, reportedly for purposes of PTC. This was before the September 2009, Chatsworth, CA accident between Metrolink and UP that led to the RSIA within 2 months. The purchase of 220 by UP would seem to indicate that there was some forethought on UP's part as to what they would require for PTC. However, given the following discussion as to understanding the demand for wireless, I suggest that there was little to no forethought as to what they ***needed***, but rather what they ***wanted***, i.e., more and more spectrum. And, they played the "safety" card to get it. I state this for two reasons. First, clearly UP has no true interest in deploying PTC as neatly and brutally stated by the CEO in September, 2011 (paraphrased).

> PTC is a "terrible waste of money", and President Obama should junk the idea.
>
> UP CEO, Jim Young, September 2011.

Mr. Young also stated that PTC "is not proven to work." Obviously, he is wrong about that, but it may explain somewhat his position on the expenditure. Perhaps, he is confusing the functionality of PTC, which ***does work***, with the complexity of the wireless network that UP's technicians are developing and that has yet to be provided by Meteorcomm (also owned by PTC-220). It should be noted that in

a recent discussion with a senior executive at BNSF, that individual noted that BNSF is moving forward with PTC because "it is the right thing to do."

The second reason that I believe that there was no significant forethought as to why UP needed 220 is simply due to the fact that UP's technicians never determined what their actual data requirements would be to deploy PTC. They so admitted this point in their submission to the FCC's *Public Notice* (addressed later). Actually, it may even be worse than that. That is, they may have made gross estimates / assumptions based upon past system pursuits, as discussed below.

Understanding Demand

PTC is a locomotive-centric system, meaning that data are sent to it, and there is very little requirement for wireless communications from the locomotive to the wayside or back office. Additionally, the amount of data that is required for PTC varies substantially as to the type of traffic control, e.g., signaled vs. non-signaled (a.k.a. dark), and volume of traffic. Most importantly, PTC is substantially different than the advanced traffic control and management systems that have been explored in the past. I expect that this difference was not understood by UP given my earlier statement as to the possibilities of UP's gross estimates. Indeed, it is likely that UP's technicians have been using their experiences with three past advanced traffic management and control systems to judge the requirements for PTC. Such analyses may be further exaggerated given that each of the three pursuits failed due to some combination of technical, functional, and political reasons. First, there was the ATCS effort noted earlier, followed by UP's disastrous vital-office ***Precision*** Train Control™ (not ***Positive*** Train Control), and finally the NAJPTC sham that was perpetrated by the railroads to keep the FRA off their backs relative to mandating PTC. This was a project that the railroads didn't want to succeed in other than delaying any Federal aggression to mandating PTC. In that regard, NAJPTC was a success for the railroads.

To make the point as to the differences in data transmission requirements for PTC as to different traffic control systems, I offer the following simplistic table.

	To Train	From Train
PTC dark	Infrequent Data	Infrequent Pings
PTC signals	Moderate Data	Frequent Pings
Advanced Systems	Intense Data	Moderate Data

Granted, a table with specific quantities would be more revealing. However, those numbers don't exist in

any credible fashion. And, if those numbers did exist, then they wouldn't be necessarily appropriate for the simple reason that the frequency and amounts of data transmissions would be based upon some obituary criteria that could use further scrutiny if wireless becomes a constraint. e.g., should the system ping the switch 10 miles ahead every 10 seconds... or ... 2 minutes, etc.

Submissions

There were a number of submissions made to the *Public Hearing*, including PTC-220 and various passenger operations. Below, I highlight a number of the unfortunate, incorrect and shamefully misleading statements that were made by several of the submitting entities.

PTC-220

"*In January (2011), PTC-220 contracted with Transportation Technology Center, inc. (TTCI) to perform spectrum analysis for railroad operations in multiple urban areas. Once completed these studies should produce ...*"

First of all, TTCI has at least an implied conflict of interest in performing such a study given their AAR ties. More importantly, however, they are apparently not qualified to do such an analysis for no other reason than they had not been able to deliver results within the 5-6 months available to them prior to PTC-220's submission. Such data modeling is quite straight forward and would be best performed by an independent Operations Research (OR) organization. In fact, members of my consultancy, ***Maendeleo Rail***[3] could readily perform such analysis within several months.

"*PTC-220 has performed an initial evaluation of potential congested areas where PTC-220 spectrum capacity will be challenged due to the density of rail operations" , and the submission lists 22 cities.*"

I suspect that evaluation process was quite simple, as in "where are there a bunch of trains". By their own admission PTC-220 did no modeling and therefore has no credible way to tell what is a choke point for PTC, Additionally, I suspect that their simplistic analysis failed to separate out the yard crews which are a major source for voice communication congestion, but not a consideration as to data.

"*Below is a brief review of other train control systems that have been tested and/or deployed.*" PTC-220's submission then goes on to list PTS, ATCS, NAJPTC, ETMS, and ETCS with comments as to the complexity and limitations of the wireless systems, thereby implying that PTC will need extensive & complex wireless networking.

[3] A brochure for Maendeleo Rail is available upon request: comarch@aol.com

Wow!, what a horrific, if not devious, misrepresentation of issues provided by this set of statements. As noted in the table earlier, there are substantial differences as to the data requirements, either to or from the locomotive, when comparing PTC with advanced control systems. Most interestingly, they didn't comment on ARES which was an advanced traffic control system that used only several 160 channels carved out from the railroads' band traditionally used for voice. Also not mentioned was CBTM, although only a test system, for which I purposely selected 160 channels that most railroad technicians would not have considered given their consistent misjudgement of the availability of 160 channels outside of major metropolitan areas.

APTA

"*The spectrum required must be in the 217-220 MHz range to meet the designs of this evolving technology and be compatible with the spectrum already purchased by America's freight railroads, primarily in the 220 MHz band.*"

In my discussions with APTA subsequent to their submission, it was implied that they were misled by PTC-220 on the above point, and perhaps other points, and have not been able to get a clear response to their questions regarding the falsehood. The real truth is that "evolving technology" as they noted, such as the Mobile Access Router (MAR) that is already included in the on-board PTC platform, as well as the opportunity for Software Defined Radio (SDR), offers a wide variety of alternatives other than only 220.

Joint Powers Board

"*Preliminary capacity rough estimates suggest a need for eight to twelve channels of 25 kHz bandwidth to provide PTC within the rail corridor controlled by Caltrain operations. ...However, RF interference analysis has not yet been performed which could potentially determine that additional spectrum beyond the twelve 25 kHz channels estimated will be needed to mitigate interference or other issues. In addition, carriers and the Commission must account for the likely evolution of PTC applications, which could generate greater spectrum requirements.*" Also, they state the requirement to "*provide the required interoperability with a single data radio*."

There is so much wrong with these statements starting with the convenient numbers of 8-12 channels and the 25kHz dimension that was chosen by UP technicians for extensive throughput, which is in fact not a requirement for relatively simple PTC messages (other than track data base downloads that are handled via WiFi). Second, I really doubt that their rough estimates took into consideration the frequency and throughput

requirements of PTC data messages. Additionally, they want the spectrum for other than just PTC ("the evolution of PTC applications"). Oops, someone really doesn't understand PTC ... or perhaps they revealed their true intent for additional spectrum. Lastly, they believe they need to be confined to single radio, which really isn't the case given the availability of the MAR. I'm quite sure they weren't thinking about SDR when they stated that.

Alas! Much of the above seems to suggest the same parroting process that is often highlighted on the *The Daily Show*. I am referring to the occasional segment of the TV show where a number of reporters or Congressmen from one party are quoted regarding some particular situation that took place that day in which the individuals use the exact same term or phrase. In my opinion, APTA, JSB, and other passenger operators drank the ***Kool Aid™*** served up by PTC-220.

Asked & Answered

Based upon my discussions with passenger operations as well as the FCC, I believe I can best emphasize critical points by asking and answering the questions that seem to be the most prevalent on their minds as to the use of wireless for PTC.

Did the PTC mandate require any specific technology, including 220?

NO! The mandate had no technical specifications.

Did the PTC mandate create the need to seek out 220?

NO! UP / NS had already purchased the spectrum. CSX and BNSF had selected other wireless solutions for PTC.

Is 220 the one & only spectrum that will support PTC?

NO! The PTC on-board platform incorporates a Mobile Access Router (MAR) that will provide for multiple wireless routes, including already 220, WiFi, and cellular.

Will the current amount of 220 owned by PTC-220 service the freight railroads?

There has been no data modeling performed to demonstrate one way or the other. But, there is no question in my mind that it will be a tremendous overkill.

Will the current amount of 220 owned by PTC-220 service the passenger railroads?

There has been no data modeling performed to demonstrate one way or the other. But, I can't imagine why the current 220 could not handle passenger operations. Additionally, the passenger railroads have no obligations to use 220 on their own property.

Do the railroads have a strategy as to how they will use the 220 for other than PTC?

PTC-220's request for additional spectrum has been made for the purpose of PTC only, However, it is very likely that several roads,

now represented by PTC-220, have a bottom-line motive for other uses of the spectrum beyond that of on their PTC, e.g., selling time to the passenger operations.

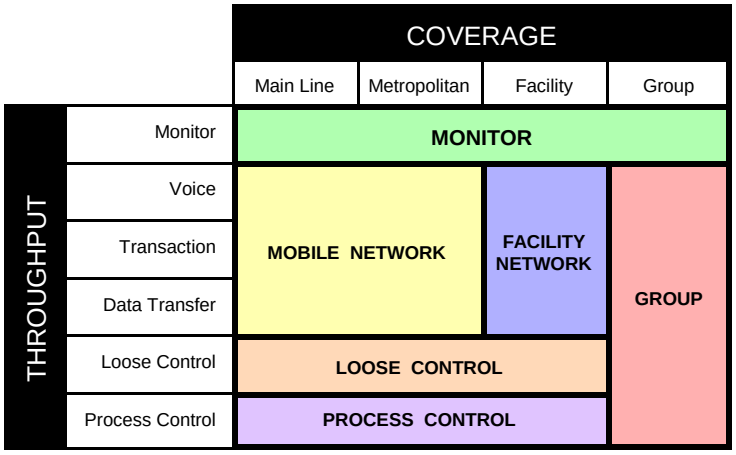
Moving Forward

In addressing wireless requirements there are two primary parameters to consider: ***throughput*** and ***coverage***. For an entire railroad evaluation (versus PTC only), those two parameters can be defined based upon 2 studies that I have performed in the industry in the last decade.

THROUGHPUT: Instead of using the usual quantification of amount / time unit, it is beneficial for a strategic perspective to consider various types of functionality such as: **Monitoring** (e.g., switch position), **Voice** (e.g.,manual authorities), **Transaction** (e.g., work order), **Data Transfer** (e.g., digital authorities), **Loose Control** (e.g., codeline), and **Process Control** (e.g., moving block).

COVERAGE: is separated into 4 categories for a railroad based upon the basic constraints of various wireless technologies, e.g., Wi-Fi versus private VHF network. Specifically, there is **Main Line** (between yards), **Metropolitan** (major cities), **Facility** (e.g., yard) and **Group** (e.g., work gang or train).

Below, is a holistic perspective of the wireless requirements for an individual railroad based upon first classifying a wide range of wireless-based applications as to throughput and coverage requirements, and then consolidating those 24 blocks (6 throughput X 4 coverage) into 6 "Wireless Corridors" as shown below.



Each of these wireless corridors can be handled with an individual set of wireless technologies that would not be cost-effective for a different corridor. For example, the ***Facility Network*** corridor would most likely use some combination of Wi-Fi, Wi-Max, satellite, celluar, and VHF, whereas the ***Mobile Network*** may only consider private VHF and cellular.

The primary justification for performing such an analysis is three-fold. First, no one technology will be the most cost-effective for all wireless requirements. Second, applications can likely be combined to share a wireless corridor, thereby minimizing the capital expenditure in wireless infrastructure while permitting the deployment of applications that could not support an individual wireless approach. Third, for some corridors it may be most

beneficial to blend technologies, including SDR that can facilitate such blending.

Applying this concept of wireless corridors to the deployment of PTC, I see some significant advantages given the pursuit of additional spectrum by PTC-220. That is, recognizing that PTC-220 has, hopefully, the responsibility to justify their request for spectrum in front of the FCC, and that they have failed to do so thus far (in fact they have misrepresented the issues involved), then it is clear that they need to use credible data models. However, as noted earlier, there are significant differences as to the throughput requirements of PTC based upon the type of traffic control system in use and the level of traffic density. With this point in mind, I suggest the following simplistic view of ***"PTC Wireless Corridors***", if you will, versus the holistic perspective described above.

PTC's Wireless Corridors

- **Dark Territory**
- **Signaled Territory** - medium density
- **Signaled Territory** - high density
- **Major Metropolitan** - freight
- **Major Metropolitan** - passenger

Each of these corridors justifies an individual analysis as to PTC data requirements, and subsequently the spectrum(s) to be considered, both private and commercial.

CLOSING POINTS

As a considerable user of private wireless spectrum, the railroads have a responsibility to use their allocated bands in an efficient manner, to be a good wireless citizen. Not only have they failed to do so, but they are seeking additional spectrum by playing the "safety card" of PTC to gain even more spectrum without any credible evidence to date that can justify that request.

At a minimum, the railroads should provide a credible analysis of PTC data requirements by an objective party qualified to 1. structure an appropriate and fair understanding of various categories of requirements (e.g., PTC wireless corridors), and 2. develop the respective data models and 3. perform the analyses. Lastly, with the availability of such analyses, the railroads should be required to demonstrate why their current owned and licensed spectrum is not sufficient to support PTC and, even better, deliver a holistic understanding of how wireless can advance the safety and efficiency or the railroads' operations, both individually and collectively as an industry.